A1 Cont.

a semiconductor substrate; and

a doped P/N junction integrated with said semiconductor substrate, said P/n junction comprising a depletion layer and having a shape defining a waveguide, said depletion layer comprising at least one rare-earth material for providing a coherent light source.

29. A semiconductor device according to Claim 28, further comprising a biasing device connected to said doped P/N junction for reverse biasing.

30. A semiconductor device according to Claim 28, wherein said at least one rare-earth material in the depletion layer of said doped P/N junction forms a base-collector region for a bipolar transistor.

31. A semiconductor device according to Claim 28, wherein said at least one rare-earth material comprises erbium.

32. A semiconductor device according to Claim 28, further comprising a protective layer partially on said doped P/N junction, said protective layer having a lower dielectric constant than a dielectric constant of said doped P/N junction.

33. A semiconductor device according to Claim 28, further comprising a buried reflecting layer to delimit a bottom of the waveguide.

A1 Cont.

34. A semiconductor device according to Claim 28, wherein said semiconductor substrate comprises a silicon on insulator (SOI) substrate.

35. A semiconductor device according to Claim 28, further comprising an epitaxial layer on said semiconductor substrate.

36. A semiconductor device according to Claim 28, wherein said doped P/N junction is stacked so that the shape of the waveguide is a ribbed elongated structure projecting from a surface of said semiconductor substrate.

37. A semiconductor device according to Claim 28, wherein said semiconductor substrate comprises silicon.

38. A semiconductor laser device comprising:

a semiconductor substrate;

a doped P/N junction integrated with said semiconductor substrate, said P/n junction comprising a depletion layer and having a shape defining a waveguide, said depletion layer comprising at least one rare-earth material for providing a coherent light source; and

a biasing device connected to said doped P/N junction.

39. A semiconductor laser device according to Claim 38, wherein said biasing device comprises a bipolar transistor including a base-collector region formed by said doped P/N junction.

A1 cont.

40. A semiconductor laser device according to Claim 38, wherein said biasing device reverse biases said doped P/N junction.

41. A semiconductor laser device according to Claim 38, wherein said at least one rare-earth material comprises erbium.

42. A semiconductor laser device according to Claim 38, further comprising a protective layer partially on said doped P/N junction, said protective layer having a lower dielectric constant than a dielectric constant of said doped P/N junction.

43. A semiconductor laser device according to Claim 38, wherein said doped P/N junction is stacked so that the shape of the waveguide is a ribbed elongated structure projecting from a surface of said semiconductor substrate.

44. A semiconductor laser device according to Claim 38, wherein said semiconductor substrate comprises a silicon on insulator (SOI) substrate.

45. A semiconductor laser device according to Claim 38, further comprising an epitaxial layer on said semiconductor substrate.

46. A semiconductor laser device according to Claim 38, further comprising a buried reflecting layer to delimit a bottom of the waveguide.

A1 Cont.

47. A semiconductor laser device according to Claim 38, wherein said semiconductor substrate comprises silicon.

48. A method for manufacturing a semiconductor device for electro-optic applications, the method comprising:

forming a P/N junction with a semiconductor substrate, the P/N junction comprising a depletion layer; and

doping the depletion layer with at least one rare-earth material.

49. A method according to Claim 48, further comprising providing a biasing device for biasing the P/N junction.

50. A method according to Claim 48, wherein forming the P/N junction comprises forming the P/N junction to have a shape defining a waveguide.

51. A method according to Claim 50, wherein the shape of the waveguide is a ribbed elongated structure projecting from a surface of the semiconductor substrate.

52. A method according to Claim 48, wherein forming the P/N junction comprises:

providing a semiconductor substrate comprising an N-type conductivity; and

selectively doping with P-type dopants an upper surface of the semiconductor substrate to define a first doped region.

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53. A method according to Claim 52, wherein doping the semiconductor substrate with at least one rare-earth material forms a rare-earth doped region in the depletion layer under the first doped region.

54. ~~52~~. A method according to Claim 49, wherein providing the biasing device comprises forming a bipolar transistor in the semiconductor substrate, the bipolar transistor including a base-collector region formed by the depletion layer.

55. ~~51~~. A method according to Claim 48, wherein the at least one rare-earth material comprises erbium.

56. ~~52~~. A method according to Claim 48, further comprising forming a protective layer partially on the doped P/N junction, the protective layer having a lower dielectric constant than a dielectric constant of the doped P/N junction.

57. ~~53~~. A method according to Claim 48, wherein the semiconductor substrate comprises a silicon on insulator (SOI) substrate.

58. ~~54~~. A method according to Claim 48, further comprising an epitaxial layer on the semiconductor substrate.

REMARKS

It is believed that all of the claims are patentable over the prior art. Accordingly, after the Examiner completes a thorough examination and finds the claims patentable, a

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Notice of Allowance is respectfully requested in due course. Should the Examiner determine any minor informalities that need to be addressed, he is encouraged to contact the undersigned attorney at the telephone number below.

Respectfully submitted,

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